STATE OF ILLINOIS)
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COUNTY OF WILL)

BEFORE THE POLLUTION CONTROL BOARD
OF THE STATE OF ILLINOIS

CATERPILLAR TRACTOR CO., Joliet Plant,	)	
Petitioner	)	
v.	)	PCB 79-189
ILLINOIS ENVIRONMENTAL PROTECTION AGENCY,	)	
Respondent	)	

PETITION FOR VARIANCE

Now comes Caterpillar Tractor Co. ("Caterpillar") by its attorneys, Martin, Craig, Chester & Sonnenschein, and hereby petitions the Pollution Control Board ("Board") to grant a variance to Caterpillar for particulate emissions from its Joliet plant from Rule 203(g)(1)(A) of Chapter 2, Air Pollution Control Regulations, Pollution Control Board.[1] In support of its petition,

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[1] Caterpillar, by filing this petition, does not admit that Rule 203(g)(1)(A) is enforceable. Caterpillar is filing this petition in conjunction with R79- in order to bring the emissions described into unquestioned compliance. Rule 203(g)(1) has been held invalid by the courts in Commonwealth Edison v. Pollution Control Board, 25 Ill. App. 3d 271 (1st Dist. 1974), aff'd in relevant part, 62 Ill. App. 2d 494 (1976); Ashland Chemical Company v. Pollution Control Board, 64 Ill. App. 3d 169 (3rd Dist. 1978); and Illinois State Chamber of Commerce v. Pollution Control Board, 67 Ill. App. 3d 839 (1st Dist. 1979), (on appeal No. 51671) and the mandate for the Ashland Chemical decision has been issued. Caterpillar believes, as recognized by the above courts, that the Board's attempts to promulgate Rule 203(g)(1) were legally invalid and hence of no force or effect. (See also R79- , which is a petition to adopt new regulations, rather than a petition to amend an existing regulation.) In addition, on July 12, 1979, the United States Environmental Protection Agency published a notice in the Federal Register that the Illinois State Implementation Plan was deficient in that the above-cited court decisions invalidated certain of the Board's rules.

Caterpillar states as follows:

1. Caterpillar owns and operates a manufacturing facility in Joliet, Illinois (hereinafter called the "Joliet plant"). The plant manufactures in excess of 173,000 tons of product annually which includes scrapers, bulldozers and rippers, hydraulic and hydrostatic controls and components. Approximately 7,000 people are employed at the Joliet plant to produce these products.

2. The Joliet plant is located within Joliet Township in Will County, which is within the Chicago major metropolitan area as defined in Rule 201 of Chapter 2 of the Board's regulations.

3. There are four boilers presently in operation at the Joliet plant. These boilers are used to produce steam to serve certain production processes and for heating and ventilating buildings. Boilers 1 and 4 have been converted from coal-fired units to gas-fired units. Boilers 2 and 3 were built in 1950 and 1952 respectively and have continued in operation since that time; therefore, they are "existing" boilers within the meaning of the Board's regulations. Boilers 2 and 3, which are the subject of this variance petition, are coal-fired spreader stoker industrial boilers and have the following maximum design firing rate:

Boiler 2 100.0 MMBTU/hr.

Boiler 3 125.0 MMBTU/hr.

Both of these boilers are equipped with multi-clone dry particulate dust (flyash) collection devices which are typical of the

spreader stoker industrial boiler design and these multi-clones are still in operation today. Boilers 2 and 3 at the Joliet plant used approximately 23,200 tons of coal in 1978, with approximately 3,500 tons of coal burned each month during the heating season. The coal burned is Illinois coal having an average sulfur content of 2.8%, a heating value of 10,709 BTU (recent analysis) and an ash content of about 10%.

4. On April 23, 1972, the Board adopted emission limitations which were applicable to the coal-fired boilers at the Joliet plant. (For Caterpillar's position on the present applicability of those regulations, please see footnote 1.) If those emission regulations are applicable, the Joliet plant boilers would be required to meet the following:

	Particulate Emissions	SO2 Emissions
Boilers 2 and 3	0.1 lbs./MMBTU	1.8 lbs./MMBTU

5. In 1970, Caterpillar decided, in response to probable energy supply restraints and environmental regulations with respect to its coal-fired boilers, that its best long term fuel source for its coal-fired boilers was Illinois coal. This commitment to Illinois coal left Caterpillar no other alternative than to begin to develop a program to install flue gas desulfurization ("FGD") systems on its coal-fired boilers in Illinois in response to the Clean Air Act mandate for continuous emission control for SO2. Caterpillar conducted extensive investigation

into the availability and successful operation of FGD systems throughout 1971 and 1972. Caterpillar's analysis showed that there were no proven full-scale systems directly applicable to coal-fired spreader stoker industrial boilers on the market. Caterpillar sought out manufacturers and consultants to assist it in the development of FGD systems. These firms included among others, Zurn Industries, Inc., Air Systems Division ("Zurn"), and Arthur D. Little. Because of the time constraints contained in the Clean Air Act, and the compliance date adopted by the Board in R71-23 with respect to Rule 204, Caterpillar had no other alternative, if it was to use Illinois coal, than to proceed to install full-scale prototype FGD systems that had not been adequately demonstrated through pilot plant development for Caterpillar's boilers. After the developmental work, Caterpillar chose the regenerative double alkali system as the method to serve a dual purpose--remove both SO2 and particulate matter from the boiler emissions. Caterpillar contracted for the installation of those systems with two manufacturers. Zurn was awarded a contract to install an FGD unit on existing boilers 2 and 3 at the Joliet plant. FMC Corporation, Environmental Engineering Division ("FMC"), received a contract to install an FGD unit on boilers 1 and 2 and future boilers 4 and 5 at Caterpillar's Mossville plant. Since these FGD units were, and still are, incompletely developed innovative technology, it was no surprise to Caterpillar and its contractors that substantial technical difficulties were experienced in the construction and operation of said units. Those problems and the attempted

solutions are outlined in detail later in this paragraph and in the petition for variance for the Mossville plant (PCB 79-191).[2] Even while those difficulties continued, and Caterpillar was not yet convinced that the FGD systems would attain the allowable emission levels for SO2 and particulate, Caterpillar's plants at East Peoria, Mapleton and Morton committed to FGD systems for their respective facilities. Caterpillar and Zurn believed that after the FGD systems were installed and operative, the emissions from the Joliet boilers would meet the applicable emission limitations for SO2 and particulate matter. However, Zurn and Caterpillar both recognized that the FGD system was unproven innovative technology when they signed the contract for the Joliet plant's FGD system. Since the decision was made to install the Zurn FGD systems at the Joliet plant, Caterpillar and its contractors have made substantial efforts to make the FGD systems meet the emission limitations set forth in paragraph 4, herein. The following is a chronological history of Caterpillar's efforts to utilize available Illinois coal with a sulfur content of 2.8% and emission limitations at the Joliet plant:

January 31, 1973. Applications for construction permits authorizing the installation of the FGD systems were filed with the Illinois Environmental Protection Agency ("IEPA").

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[2] The allegations of that petition are hereby incorporated in this petition as though fully set forth herein.

June 1, 1973. Caterpillar formally contracted with Zurn Industries to install the dilute regenerative double alkali FGD system on boilers 2 and 3 at the Joliet plant.

May 4 and 10, 1973. Construction permits #C302010 and #C302138 were issued by the IEPA.

September 10, 1973. Construction of the FGD systems began.

October 1, 1974. Initial start-up of the FGD systems at the Joliet plant occurred. Operational problems were immediately apparent many of which were attributed to lack of engineering experience in the design of the system, selection of proper equipment and materials of construction.

December, 1974. Initial system rework was undertaken to correct the water balance in the slurry system and to install a lime slaker.

June, 1975. Chemical portions of the FGD systems were reworked to provide for an overflow retention pump, increased storage capacity and access platforms for the FGD equipment.

December, 1975. The first formal stack tests were conducted on boilers 2 and 3 at the Joliet plant by Battelle-Columbus Laboratories. The results of the stack tests were completed and submitted to the IEPA on April 7, 1976. The report showed that probably the emissions of sulfur dioxide would be below 1.8 lbs./MMBTU. However, the tests showed that particulate limitation emissions were probably in excess of .1 lbs./

MMBTU, but they were not calculated according to reliable "F" factor methods.

July 14, 1976. Following a request by the IEPA, additional information with regard to the stack tests were submitted.

Summer, 1976. Guillotine dampers were installed on the bypass stacks for both boilers 2 and 3. The mist eliminator system was reworked, and chemical system process pumps and piping were replaced in order to minimize or eliminate the corrosion and erosion problems which had been experienced. The lime slaker was removed and replaced with a hydrated lime premixed tank.

September 3, 1976. The stack tests conducted by Particulate Data Laboratories were submitted to the IEPA indicating that particulate emissions remained a problem.

Winter, 1976. Caterpillar consulted with experts of the Detroit Stoker Company and Erie City Boiler Company to determine if the particulate emisssions problem could be traced to the boilers. Experts from the companies evaluated the boilers and recommended that a stack test be rerun utilizing a different grade of coal.

March, 1977. Following this recommendation, Caterpillar obtained this different grade of coal and conducted extensive preliminary stack tests for particulate emissions.

March 29 and 30, 1977. Caterpillar conducted stack tests referenced in paragraph 6. These tests showed compliance with the SO2 limitations, but failure to comply with the particulate limitations.

June 7, 1977. The results of these stack tests were submitted to the IEPA. Caterpillar indicated that at that time neither it or any of the manufacturers or consultants involved to date were aware of any definite solution to correct the particulate emission problem.

Summer, 1977. In an attempt to prove the reliability of the FGD systems, Caterpillar reworked the flow control system and made additional modifications to pumps and piping. Caterpillar also developed and installed a FGD slurry scrubber pilot plant on a flue gas lead stream from boiler 2.

Winter, 1977-1978. Caterpillar conducted pilot plant testing on the FGD venturi scrubber. The results of this pilot plant study indicated that the venturi scrubber system was not capable of solving the particulate emission problem associated with the coal-fired spreader stoker industrial boilers at the Joliet plant.

Summer, 1978. Caterpillar again reworked the flow control system of the FGD chemical regenerative system to prove system reliability.

Present. Caterpillar is continuing to attempt to achieve compliance.

6. Caterpillar has attempted to determine the performance of its FGD systems with regard to controlling particulate and SO2 emissions. In that attempt, Caterpillar has performed stack tests on boilers 2 and 3. The results of those tests are as follows:

A. Boiler 2

(i) May 18, 1979
with ash reinjection at
64,000 to 65,500 lbs. steam/hr.
varying

0.248 lbs./MMBTU Particulate
N/A - SO2

(ii) May 18, 1979
without ash reinjection at
62,500 to 67,000 lbs. steam/hr.

0.190 lbs./MMBTU Particulate
N/A - SO2

(iii) March 29-30, 1977, with ash
reinjection at 70,000 lbs. steam/hr.

0.219 lbs./MMBTU Particulate^
0.242 lbs./MMBTU SO2

B. Boiler 3 - March 29-30, 1977 with
ash reinjection

(i) at 100,000 lbs. steam/hr.

0.279 lbs./MMBTU Particulate^
0.161 lbs./MMBTU SO2

(ii) at 80,000 lbs. steam/hr.

0.202 lbs./MMBTU Particulate^
0.416 lbs./MMBTU SO2

^Test meets full requirements of Method 5.

As can be seen by the testing data, the particulate emissions are above the design level of .1 lbs./MMBTU and SO2 emissions are below the design level of 1.8 lbs./MMBTU.

7. Caterpillar believes that portions of the excess particulate emissions are attributable to the carryover of sulfuric acid mist and scrubber liquor salts (commonly and herein referred to as sulfur trioxide mist and sodium salts) from the FGD systems. Chemical analysis conducted on the particulate matter collected

during the March 29 and March 30, 1977 stack tests at the Joliet plant show that an average of 17.7% of the total particulate matter collected is attributable to sulfur trioxide mist and sodium salts from the FGD system. Chemical analysis performed on the particulate matter emitted from the FGD system at the Mapleton plant during stack tests conducted on June 5, 1979, show that an average of 35.2% of the total particulate matter collected is attributed to sulfur trioxide mist and sodium salts. Chemical analysis conducted on the particulate matter collected during the April 24-27, 1979, and June 29, 1979, stack tests of boilers 4 and 5 at the Mossville plant show that approximately 50% of the total particulate matter collected is attributed to sulfur trioxide mist and sodium salts. These analyses show that significant portions of the "particulate matter" emitted are generated in the FGD system itself. The United States Environmental Protection Agency ("USEPA") has acknowledged that sulfur trioxide mist is increasingly present in emissions from sources of higher sulfur content coal and has attempted to negate its influence in modifying stack test procedures. However, using the USEPA Test Method #5, anything other than gas or vapor that is not pure water and is emitted in a finely divided form is deemed particulate matter.

8. The Zurn system was designed to remove the particulate matter in excess of one micron in diameter. There was no information available to Caterpillar, or anyone else,

at the time that it entered into the contract to purchase the Zurn FGD system in 1973 which would indicate that particulate matter less than one micron in diameter could be expected to be present in any appreciable amounts in emissions from coal-fired spreader stoker industrial boilers. Even if it could have been expected that submicron particles would be present, there was no evidence that the FGD system would not remove them. Stack test results at both Caterpillar's Joliet and Morton plants indicate that particulate emissions from the multi-clones to the FGD systems of the coal-fired spreader stoker industrial boilers have a particle size composition with 50% of the particles having a diameter of one micron or less. Caterpillar has been actively seeking a method to reduce the amount of submicron particulate matter emitted. In order to attempt to solve this problem, Caterpillar has hired four combustion experts. The first is Black and Veatch, who are studying the problem on new boilers at the East Peoria plant. The second and third are the Detroit Stoker Company and the Erie City Boiler Co., Division of Zurn Industries, who examined the boiler emissions at Caterpillar's Joliet plant. The fourth is Rogers-Schmidt Engineering Co., who is examining the boiler emissions at the Mossville plant. As a result of these studies, Caterpillar has identified four areas of concern:

A. The first area of concern is the quality of the coal burned in the boilers. Because coal is not stored under roofs, it is exposed to the elements so that at many times during the year almost a liquid sludge can be fed into the boilers due to the high moisture

content. As the moisture is driven out and evaporated during the combustion process, the fire periodically flashes causing a fluctuation in heat output as combustion characteristics vary. In addition, the ash content of the coal can vary depending upon its quality. Caterpillar has begun a quality assurance program to attempt to maintain high quality coal for combustion in its coal-fired boilers in Illinois.

B. The second area of concern is the required control over excess air in coal-fired industrial boilers. The theoretical design factor for spreader stoker industrial boilers is 30% excess air under perfect conditions. However, as previously indicated because of changes in the moisture content and other factors, the theoretical conditions are seldom, if ever, attained. The varying moisture content causes upsets in fire box conditions which can last for long periods of time. Although spreader stoker industrial boilers are normally fast responders to the effect of rapid load changes, it is very difficult to adjust excess air in industrial coal-fired boilers to

precisely the optimum design conditions with these rapidly varying loads. Caterpillar's experience, with close attention to control, is that it may maintain excess air down to approximately 45% in existing boilers for short periods of time, and over long periods of time can reach the 75% to 100% range. Coal with a higher sulfur content has a lower ash fusion temperature so that more air is required to come through the grate to keep the ash bed below solidification temperatures. This problem increases because the greater the amount of under fire air, the more the fire bed is stirred up causing a rise of fine particulates.

C. The third area of concern is the method boiler combustion experts believe can be utilized to control a portion of the particulate emissions. The experts have recommended that the over fire air system on some of Caterpillar's existing boilers be completely revised. This would constitute a major boiler and stoker overhaul for all existing installations. Although the boiler combustion experts have recommended this, the stoker manufacturers will not guarantee

that better stack emissions will be achieved but only that combustion efficiency will be improved.

D. The fourth area of concern has to do with reinjection of the flyash. Normal practice in the industry is to reinject a portion of the flyash captured in the multiclones back into the boilers to burn the carbon which is carried over in the flyash. By reinjecting the flyash, boiler efficiency is increased. There is evidence that flyash reinjection increases particulate emissions; however, this evidence in inconclusive on Caterpillar's boilers. Therefore, Caterpillar is continuing to evaluate this area of concern.

As of this date, Caterpillar does not know when or if these investigations will result in the reduction of particulate matter from the FGD systems.

9. Based upon the work done on the Joliet boilers, as well as its other boilers which are equipped with scrubbers, Caterpillar is unaware of any FGD system which will reliably achieve a particulate emission rate of less than 0.1 lbs./MMBTU at rated boiler capacity when retrofitted on "existing" installations such as boilers 2 and 3 at the Joliet plant. Caterpillar is continuing to search for such a system as well as to continue to work on the existing FGD systems even though Caterpillar believes that it has installed

the best available technology.

10. Caterpillar has spent approximately $4,200,000 to date to purchase and install FGD systems at the Joliet plant. The FGD operational cost is approximately $10/ton of coal burned.

11. Because Caterpillar presently is unaware of any method to achieve the SO2 emission limitations found in Rule 204 and at the same time to achieve the particulate emission limitations found in Rule 203(g)(1)[3] while burning Illinois coal, it has filed a regulatory amendment on September 5, 1979, which is docketed as R79-11. The proposal would have the Board adopt a specific particulate emission limitation of 0.25 lbs./MMBTU on a routine day-to-day basis for those coal-fired spreader stoker industrial boilers equipped with FGD systems. Given the expenditures made by Caterpillar in an attempt to control particulate and SO2 emissions from the Joliet plant's boilers, and for that matter, all of the coal-fired boilers at Caterpillar's facilities in Illinois, Caterpillar does not believe that it is economically reasonable to require reduction of particulate emissions by either adding some additional type of control system, if it were available for these boilers, or if a system was demonstrated to be available to replace the existing control system with a new generation of technology. At the same time Rule 203(g)(1) and Rule 204 were adopted, the systems employed by Caterpillar were described as best available control technology and were cited as the basis

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[3] See Footnote 1.

for the technical feasibility for this adoption and great emphasis was placed on the so-called guarantees available (although refuted by Caterpillar. The systems have not performed up to their expectations. Based upon this economic unreasonableness and perhaps even the technical infeasibility of FGD systems to control particulate matter emissions to low levels, Caterpillar believes that its regulatory petition has a good chance for adoption.

12. Caterpillar is not causing a violation of either the primary or secondary ambient air quality standards by operating boilers 2 and 3 at the Joliet plant. Therefore, Caterpillar does not believe that the granting of this variance will adversely affect ambient air quality.

13. Failure to grant a variance to Caterpillar will create an arbitrary or unreasonable hardship, as that term is used in the Environmental Protection Act. Caterpillar has exercised good faith and its best efforts to install best available technology to control the emission of particulate matter and SO2 from its boilers while burning Illinois coal--the FGD system, in combination with the use of multi-clone flyash arrestors. While Caterpillar, as outlined herein, is continuing to evaluate the present on-line system, and is investigating new FGD systems, it is obvious that the emissions from Caterpillar's Joliet boilers cannot meet the emission limitations of Rule 203(g)(1)(A) (see footnote 1). Further, Caterpillar's emissions of particulate matter do not have a significant, if any, impact on the ambient air quality. When such efforts have been made, without en-

vironmental impact, a variance should be granted.

WHEREFORE, Caterpillar requests that the Board grant it a variance from Rule 203(g)(1)(A), for boilers 2 and 3[4] until December 31, 1982, or until final action is taken with respect to R79-11, whichever occurs first. Caterpillar requests that a hearing be held, and that the variance when granted be submitted to the USEPA as an amendment to the Illinois State Implementation Plan pursuant to Section 110 of the Clean Air Act.

CATERPILLAR TRACTOR CO.

By: _____
Executive Vice President

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[4] See Footnote 1.

CERTIFICATE OF SERVICE

I, Barbara C. Ammer, having been duly sworn and under oath, do state that I have this 5th day of September, 1979, served the foregoing Notice and Petition for Variance, upon the person to whom said Notice is directed by placing in an envelope addressed to said person, postage prepaid, and depositing with the United States Postal Service, located at 115 South LaSalle Street, Chicago, Illinois, 60603.

Barbara C. Ammer

Subscribed and sworn to
before me this 5th day
of September, 1979.

Mary Kirchman
Notary Public